

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

~~David Alan FORD et al.~~

Application No.: 09/859,532

Filed: May 18, 2001

Docket No.: 109528

For: SINGLE CRYSTAL SEED ALLOY

CLAIM FOR PRIORITY

Director of the U.S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

The benefit of the filing date of the following prior foreign application filed in the following foreign country is hereby requested for the above-identified patent application and the priority provided in 35 U.S.C. §119 is hereby claimed:

Great Britain Patent Application No. 0012185.5 filed May 20, 2000

In support of this claim, a certified copy of said original foreign application:

 X is filed herewith.

 was filed on in Parent Application No. filed .

 will be filed at a later date.

It is requested that the file of this application be marked to indicate that the requirements of 35 U.S.C. §119 have been fulfilled and that the Patent and Trademark Office kindly acknowledge receipt of this document.

Respectfully submitted,



James A. Oliff
Registration No. 27,075

Thomas J. Pardini
Registration No. 30,411

JAO:TJP/cmm

Date: September 17, 2001

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INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation and Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein together with the Statement of inventorship and of right to grant of a Patent (Form 7/77), which was subsequently filed.

I also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Signed

Andrew Gersey

Dated 22 May 2001

OLIFF & BERRIDGE, PLC

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APPLICANT: David Alan FORD et al.

APPLICATION NO.: 09/859,532

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FOR: SINGLE CRYSTAL SEED ALLOY

ATTORNEY DOCKET NO.: 109528

The
Patent
Office

THE PATENT OFFICE

M

20 MAY 2000

NEWPORT

1/77
22 MAY 00 E538540-1 D01097
P01/7700 0.00-0012185.5

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference PAT/VJB/2785

2. Patent application number 0012185.5 20 MAY 2000
(The Patent Office will fill in this part)

3. Full name, address and postcode of the or of each applicant (underline all surnames) ROLLS-ROYCE plc
65 BUCKINGHAM GATE
LONDON
SW1E 6AT
GREAT BRITAIN

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

GREAT BRITAIN

3970002

4. Title of the invention SINGLE CRYSTAL SEED ALLOY

5. Name of your agent (if you have one) MR V J BIRD

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

INTELLECTUAL PROPERTY DEPT EW 1-5
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HA SELTINE LAKE & CO
IMPERIAL HOUSE
15-19 KINGSWAY,
LONDON, WC2B 6UB

Patents ADP number (if you know it)

EC/177 MP

34001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number
22/5/01 Country Priority application number (if you know it) Date of filing (day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application
Number of earlier application Date of filing (day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	0
Description	2
Claim(s)	1
Abstract	0
Drawing(s)	0

10. If you are also filing any of the following, state how many against each item.

Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent (<i>Patents Form 7/77</i>)	NO
Request for preliminary examination and search (<i>Patents Form 9/77</i>)	NO
Request for substantive examination (<i>Patents Form 10/77</i>)	NO
Any other documents (<i>please specify</i>)	NO

11. I/We request the grant of a patent on the basis of this application.

Signature

Date

19 MAY 2000

12. Name and daytime telephone number of person to contact in the United Kingdom

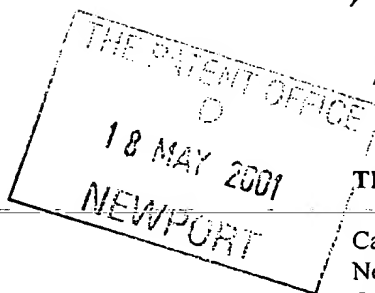
MR V J BIRD 0117 979 7137

Warning

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Notes

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The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

Statement of inventorship and of right to grant of a patent

1. Your reference HL78766/000

2. Patent application number 0012185.5
(if you know it)

3. Full name of the or of each applicant Rolls-Royce plc

4. Title of the invention
SINGLE CRYSTAL SEED ALLOY

5. State how the applicant(s) derived the right
from the inventor(s) to be granted a patent

By virtue of the inventors' contract of employment

6. How many, if any, additional Patent Forms
7/77 are attached to this form? None
(See note (c))

7. I/We believe that the person(s) named over the page (and on
any extra copies of this form) is/are the inventor(s) of the invention
which the above patent application relates to.

Signature *Harrell*

Date

17 May 2001

8. Name and daytime telephone number of
person to contact in the United Kingdom Mr. J.R.A.M. Cheyne [0117] 9103200

Notes

- a) If you need help to fill in this form or you have any questions, please contact the patent office on 0645 500505.
- b) Write your answers in capital letters using black ink or you may type them.
- c) If there are more than three inventors, please write the names and addresses of the other inventors on the back of another Patents Form 7/77 and attach it to this form.
- d) When an application does not declare any priority, or declares priority from an earlier UK application, you must provide enough copies of this form so that the patent office can send one to each inventor who is not an applicant.

Enter the full names, addresses and postcodes of the inventors in the boxes and underline the surnames

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Reminder:
Have you signed this form?

SINGLE CRYSTAL SEED ALLOY

This invention concerns the composition of a metal alloy suitable for use as single crystal seeds.

Components cast as single crystals, using the process of directional solidification, generate a crystal atomic structure related to the growth of preferred crystal planes. In nickel base superalloys the resultant crystal has a structure determined by growth of the $\langle 001 \rangle$ crystal planes. This structure is aligned in the direction of solidification which is normally along the principal geometric axis of the component e.g. a gas turbine engine blade aerofoil.

In certain cases there are applications for components with crystal orientations different to the $\langle 001 \rangle$ produced under normal solidification conditions. Such applications include nozzle guide vanes and turbine blades requiring control of material rigidity.

To produce a crystal structure aligned in a direction other than the preferred solidification growth direction it is established practice to solidify from a seed crystal which has the required crystal structure. Solidification from these seeds is by epitaxial growth in which the molten superalloy solidifies directly from a partially melted seed crystal made from the same or equivalent superalloy as the cast component.

A drawback encountered with this known method of determining crystal growth direction during solidification is that a high level of castings are rejected because the seed crystals when partially molten are liable to generate unwanted oxide films which interrupt epitaxial growth of the single crystal and cause further crystals to solidify in which the atomic orientations are randomly distributed.

The present invention has for a principal objective to overcome this drawback by providing a formulation of an alloy suitable for use in single crystal seeds and which does not produce oxide films under the directional solidification conditions used for the casting of superalloys.

According to the present invention there is provided an alloy composition suitable for use as a single crystal seed comprising a nickel superalloy containing in the proportion of 5 to 50 weight % a further metal selected from the Transition Series of elements in Period VI of the Periodic Table of Elements.

Alloy compositions in accordance with the present invention which have been investigated and found to be useful included a nickel/tungsten alloy containing tungsten in the range 5-40 weight %. However, this range of alloys was considered to be unsuitable for conventional directional solidification due to their high thermal conductivity, which made it difficult to control the rate of cooling during withdrawal from the single crystal casting furnace through its temperature transition zone.

The compositions investigated also included nickel/tantalum alloys containing tantalum in the range 10-30 weight %. A particularly successful alloy contained 20% tantalum which solidifies at about 1400°C and was found to be an effective seed alloy for the super alloy CMSX4. Tantalum levels of around 30% solidify at 1360°C and are appropriate for single crystal alloys with melting points of around 1350°C.

These compositions have melting temperatures appropriate for the majority of superalloys and have the added advantage of narrow solidification ranges which reduce the potential for secondary crystal nucleation during solidification.

CLAIMS

- 1 A single crystal seed alloy composition comprising nickel superalloy containing in the proportion of 5 to 40 weight % a further metal selected from the Transition Series of elements in Period VI of the Periodic Table of Elements.
- 2 A single crystal seed alloy composition as claimed in claim 1 wherein the further metal comprises tungsten in the range 5-40 weight %.
- 3 A single crystal seed alloy composition as claimed in claim 1 wherein the further metal comprises tantalum in the range 5-50 weight %.
- 4 A single crystal seed alloy substantially as hereinbefore described.

